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(54) Information recording medium.

(57) An optical disk includes a pair of disk-shaped substrates (52) and a pair of hubs (53). Each substrate has a recording region (50) for recording information and a center bore (52a). Each hub has a cylindrical body and collar portions (57) projecting radially from the outer circumference of the body. The hub is fixed to the corresponding substrate in such manner that the cylindrical body is fitted in the center bore and the collar portions are adhered to a surface of the substrate. The substrates fitted with the hubs are pasted together facing each other so that the collar portions are clamped between the substrates.

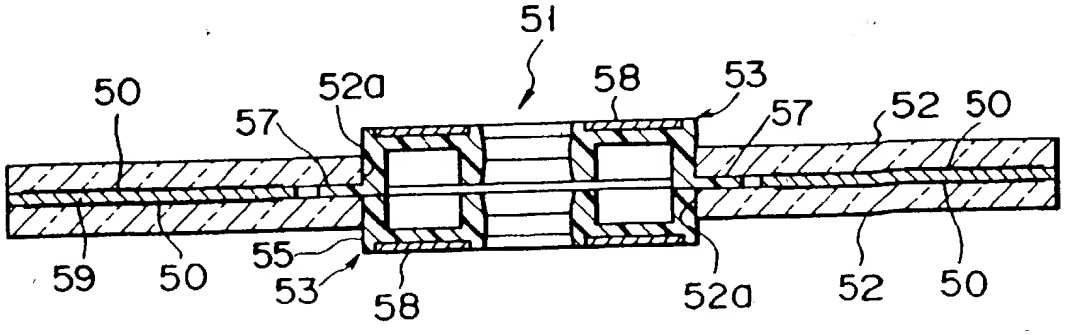

FIG. 1

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connecting the corresponding end portions of the cylinders. An annular space 56 between the inner and outer cylinders 54 and 55 is open on one end side and closed on the other end side, and the outer surface of the supporting wall 48 constitutes a supporting surface. The outer diameter of the outer cylinder 54 is substantially equal to the diameter of the bore 52a in each substrate 52. A plurality of collar portions (three in number in the present embodiment) 57 are formed intermittently or partially along the outer periphery of an open end portion of the outer cylinder 55, and extend in the circumferential direction. Fixed to the supporting surface 48a is a ring-shaped magnetic plate 58 which has a bore in the center.

In the present embodiment, the components of each hub 53 are integrally formed of synthetic resin. The magnetic plate 58, in particular, has a stepped portion (not shown) around the bore, and is formed integrally with the hub 53 by insert molding. The stepped portion bites into the resin lest the magnetic plate 58 be separated.

Each hub 53, constructed in this manner, is fixed to its corresponding substrate 52 in a manner such that its outer cylinder 55 is fitted into the through hole 52a of the substrate from the side of the recording layer 50 thereof, and its collar portions 57 are bonded to the recording-layer-side surface of the substrate by means of an adhesive agent. As shown in Fig. 1, the optical disk 51 is formed by pasting the two substrates 52, having the hubs 53 bonded thereto, with a spacer 59 sandwiched between them. In doing this, the substrates 52 are joined together with the two hubs 53 deviated from each other lest the collar portions 57 of the hubs overlap one another. Therefore, the spacer 59 need not be twice as thick as each collar portion 57, and must only be as thick as each portion 57, so that an increase of the mass of the disk can be reduced. Moreover, the capability of a spindle motor (not shown), for use as optical disk rotating means, to control variation in rotation can be improved, so that information can be reproduced from the optical disk 51 with less jittering.

The spacer 59 is in the form of a ring coaxial with the optical disk 51. The outer diameter of the spacer 59 is greater than that of each recording layer 50 which forms a recording and reproducing region, and the inner diameter of the spacer is smaller than that of the recording layer. Thus, each recording layer 50 is reinforced as a whole by the spacer 59, so that the life performance of the disk 51 can be improved. The spacer 59 is a sheet both sides of which are coated with adhesive mass, for example.

After each substrate 52 and its corresponding hub 53 are bonded together with their respective centers in alignment, the two substrates 52 are pasted on each other with the spacer 59 between them. Accordingly, the center of rotation of each substrate 52 can be easily aligned with that of the spindle motor for driving the optical disk 51. Since the collar portions 57 are sandwiched between the two substrates 52, moreover, the hubs 53 can never be disengaged from the disk 51 even if the bond portions between the collar portions 57 and the substrates 52 peel off. In removing the optical disk 51 from a turntable, for use as disk supporting means of an optical disk apparatus mentioned later, therefore, the hubs 53 can be prevented from coming off and remaining on the turntable.

Referring now to Figs. 4 to 8, a disk cartridge containing the aforementioned double-sided optical disk 51 will be described.

The cartridge 81 includes first and second symmetrical cartridge halves 82 and 83, which are connected face to face to each other. Each of the first and second halves 82 and 83 has a window 100 through which the optical disk 51 in the cartridge 81 is exposed to the outside, and which is opened and closed by means of a shutter 84 attached to the cartridge. The window 100 extends close to front end face of the cartridge 81 from the central portion of its corresponding cartridge half, along the direction C of insertion of the cartridge into the disk apparatus. When the shutter 84 is moved aside to open the window 100, the hubs 53 and the substrates 52 of the optical disk 51 are partially exposed. The shutter 84, which is formed by bending a metal plate in the shape of a U, includes a pair of plate portions 84a, individually facing the respective surfaces of the first and second halves 82 and 83, and a connecting portion 84b extending between the respective leading ends of the plate portions. A guide groove 87, which extends in the direction perpendicular to the cartridge insertion direction C, is formed on a front end face 90 of the cartridge 81 on the leading end side with respect to the insertion direction. A slider 85 of Teflon-based resin is fitted in the guide groove 87, and can slide in the perpendicular direction (direction of arrow A or B in Fig. 6), guided by the groove 87. The connecting portion 84b of the shutter 84 is fixed to the slider 85 by means of screws 86, and the shutter slides together with the slider, thereby opening or closing the windows 100. The slider 85 is urged in the direction of arrow A by means of a spring (not shown), and the shutter 84 is normally kept in a closing position shown in Fig. 6.

As shown in Figs. 4 and 5, the slider 85 is elongated in its sliding direction. An open-close pin engaging portion 87 is formed on one end side of the slider 85. One of paired open-close pins 10 and 11 of a loading mechanism (mentioned later) of the optical disk apparatus abuts against the engaging

frame 5 serves to hold and guide the cartridge 81, inserted through the loading slot 32, in the horizontal direction (insertion direction C). The distance between each supporting portion 5c and the top plate 5a is substantially equal to the thickness of the cartridge 81. A pair of leaf springs 42 are fixed to the inner surface of the top plate 5a, and the cartridge 81 inserted in the frame 5 is pressed against the supporting portions 5c by means of these springs.

The shutter operating mechanism 4 includes first and second rocking levers 8 and 9 which are substantially L-shaped. The first rocking lever 8 has a proximal end situated close to the left side edge (in Fig. 10) of the frame 5, and its proximal end portion is rockably supported on the upper surface of the frame by means of a pivot 15. Likewise, the second rocking lever 9 has a proximal end situated close to the right side edge of the frame 5, and its proximal end portion is rockably supported on the upper surface of the frame by means of a pivot 16. The open-close pins 10 and 11 are fixed to the distal ends of the rocking levers 8 and 9, respectively. Tension springs 12 and 13 are stretched between the proximal end of the lever 8 and the frame 5 and between the proximal end of the lever 9 and the frame. The springs 12 and 13 extend in the cartridge insertion direction C, and arranged in openings which are formed individually at the opposite side edge portions of the upper surface of the frame 5, with respect to the direction perpendicular to the cartridge insertion direction. Thus, the paired rocking levers 8 and 9 are urged in opposite directions by means of the springs 12 and 13, respectively.

Two arcuate guide slits 75 and 76 are formed in the frame 5 so as to be symmetrical with respect to the cartridge insertion direction C. More specifically, the guide slit 75 has a starting end situated close to the right side edge of the frame 5, and a terminal end situated substantially in the central portion of the frame and ahead of the starting end, with respect to the insertion direction C. The slit 75 is in the form of a circular arc around the pivot 15 of the first rocking lever 8. The guide slit 76 has a starting end situated close to the left side edge of the frame 5, and a terminal end situated substantially in the central portion of the frame and ahead of the starting end, with respect to the insertion direction C. The slit 76 is in the form of a circular arc around the pivot 16 of the second rocking lever 9. The open-close pin 10, which is fixed to the distal end of the first rocking lever 8, projects into the frame 5 through the guide slit 75, and moves in the slit 75 as the lever 8 rocks. Likewise, the open-close pin 11, which is fixed to the distal end of the second rocking lever 9, projects into the frame 5 through the guide slit 76, and moves in the slit 76 as the lever 9 rocks. Normally, the first and second rocking levers 8 and 9 are urged by the springs 12 and 13, respectively, so that the pins 10 and 11 are held against the starting ends of the slits 75 and 76, respectively. The pin 10 is long enough to cover the distance from the top plate 5a of the frame 5 to the position near its corresponding supporting portion 5c, while the pin 11, which protrudes from the top plate substantially to the middle of the thickness of the frame, is about half as long as the pin 10.

The following is a description of the second loading mechanism 74.

Two guide pins 77 and 78 protrude from each of the paired side plates 5b which are arranged in the direction perpendicular to the insertion direction C of the cartridge 81. The optical disk apparatus 72 further comprises a supporting frame 36 on which the motor, the optical head 34, etc. are mounted. The frame 36 includes a pair of facing side plates 79 which are arranged spaced in the direction perpendicular to the cartridge insertion direction C. The plates 79 face their corresponding side plates 5b of the frame 5. Each side plate 79 has two vertical slits 61 and 62 corresponding to the guide pins 78 and 77, respectively. The frame 5 is movable in the vertical direction, guided by the pins 78 and 77 passed through the slits 61 and 62, respectively. When the insertion of the cartridge 81 in the frame 5 (state of Fig. 12) is detected by means of sensing means (not shown), the frame 5 is driven by means of drive means (not shown) and moved in the vertical direction from an up position to a down position.

The turntable 71 is arranged on the supporting frame 36, and is situated under the holder frame 5. The turntable 71 includes a magnet 71a for magnetically attracting the magnetic plate 58 on one of the hubs 53 of the optical disk 51, and a spindle shaft 71b to be inserted into the inner cylinder 54 of the hub 53. The moment the cartridge 81 is horizontally loaded by means of the first loading mechanism 73, the shutter 84 is slid aside. Then, the cartridge 81 is moved to its down position by means of the second loading mechanism 74. Thereupon, the optical disk 51 in the cartridge 81 held in the frame 5 is supported on the turntable 71 through one of the exposure windows 100 which is opened as the shutter 84 is removed. As the spindle 71b is passed through the inner cylinder 54, the optical disk 51 is aligned with the turntable 71, and the magnetic plate 58 is attracted and fixed to the turntable by means of the magnet 71a. Thereafter, the turntable 71 is rotated by means of the motor (not shown), whereby the optical disk 51 is rotated.

In taking out the cartridge 81, an eject button 38 (see Fig. 9) is depressed. Thereupon, the sec-

recording region (50) for recording information and fixed together facing each other; and

an engagement portion (53) attached to the substrates, for engaging the supporting means (71);

characterized in that:

said engagement portion (53) includes a projection (57) fixed to at least one of the substrates (52) and clamped between the substrates.

2. An information recording medium according to claim 1, characterized in that each of said substrates (52) is in the form of a disk having a concentric bore (52a) in a central portion of the substrate, said engagement portion (53) includes a pair of substantially cylindrical hubs, each of said hubs being fitted in the bore of the substrate corresponding thereto, and said projection (57) protrudes from the outer circumferential surface of each hub.

3. An information recording medium according to claim 2, characterized in that each of said hubs (53) includes an outer cylinder (55) having an outer diameter substantially equal to the diameter of the bore (52a) of the substrate (52), and a plurality of collar portions (57) protruding radially outward from the outer circumferential surface of one end portion of the outer cylinder, with respect to the axial direction thereof, and constituting the projection, the collar portions being spaced in the circumferential direction of the outer cylinder, the outer cylinder being passed through the bore from the side of a first surface of the substrate and projecting from a second surface of the substrate. the collar portions being fixed to the first surface.

4. An information recording medium according to claim 3, characterized in that said substrates (52) are pasted on each other in a manner such that the respective first surfaces thereof face each other and the collar portions (57) of one of the hubs (53) are situated with circumferential deviations from the collar portions of the other hub.

5. An information recording medium according to claim 4, characterized in that said recording region includes a ring-shaped information recording layer (50) formed on the first surface of the substrate (52) so as to be coaxial with the substrate, and characterized by further comprising a ring-shaped spacer (59) sandwiched between the respective first surfaces of the substrates (52), the spacer being arranged coaxially with the substrates and having an outer diameter greater than that of each recording layer and an inner diameter smaller than that of each recording layer.

6. An information recording medium according to claim 5, characterized in that each of said collar portions (57) is as thick as the spacer.

7. An information recording medium according to claim 4, characterized in that each of said hubs (53) includes an inner cylinder (54) situated coaxially with the outer cylinder (55), for aligning the substrate with the supporting means (71), a ring-shaped supporting wall (48) connecting the inner and outer cylinders and situated on the second surface side of the substrate, and a ring-shaped magnetic plate (58) fixed on the supporting wall.

8. An information recording medium for reproducing information while being supported by means of supporting means, said recording medium comprising:

a pair of substrates (52) having a recording region (50) for recording information and fixed together facing each other; and

an engagement portion (53) attached to the substrates, for engaging the supporting means (71); characterized in that:

said engagement portion (53) includes a projection (57) fixed to at least one of the substrates (52) and clamped between the substrates.

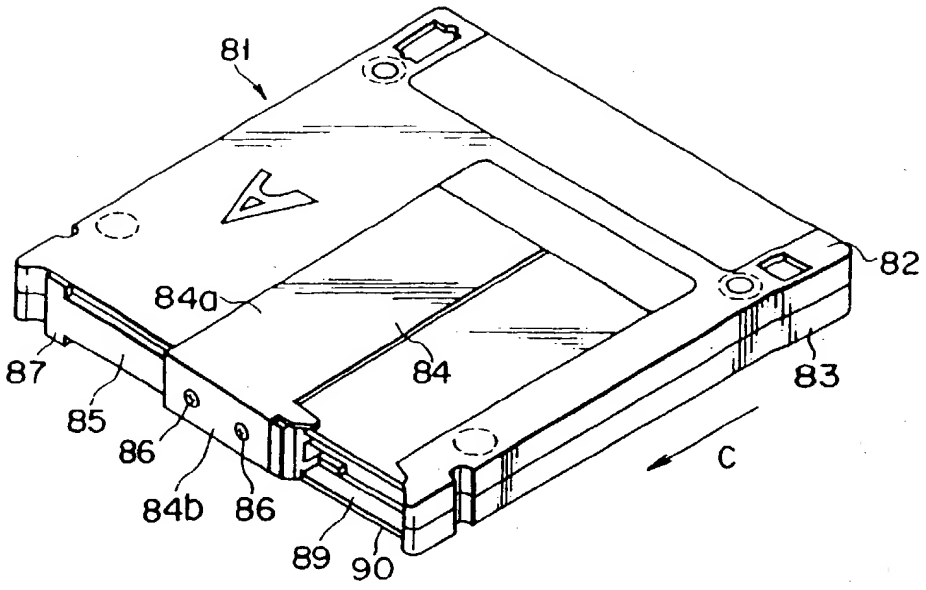


FIG. 4

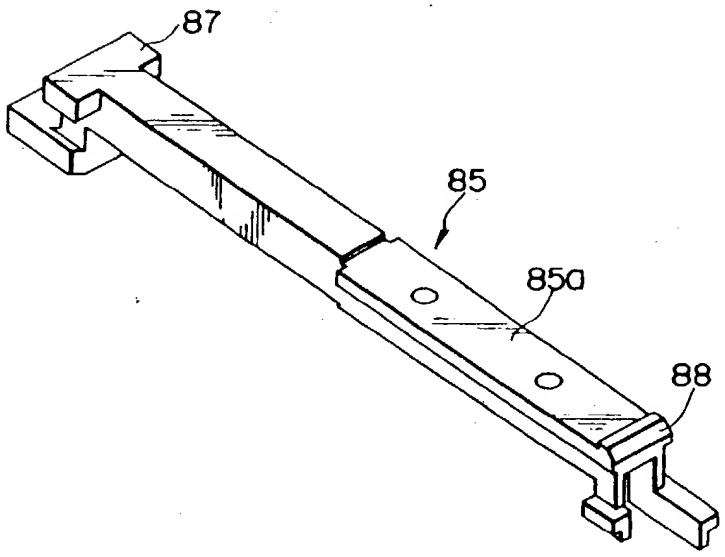


FIG. 5

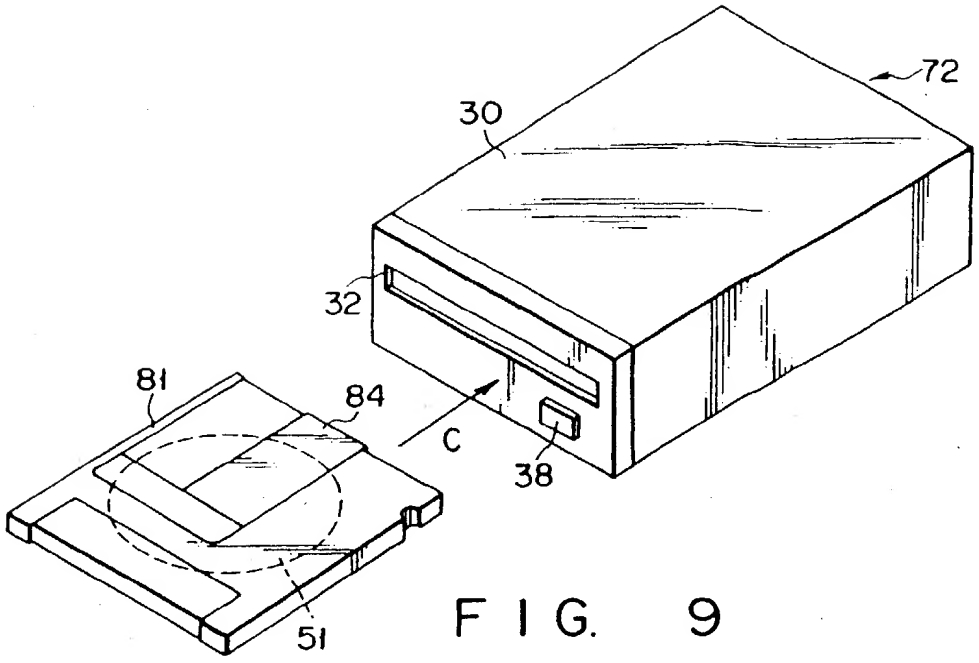
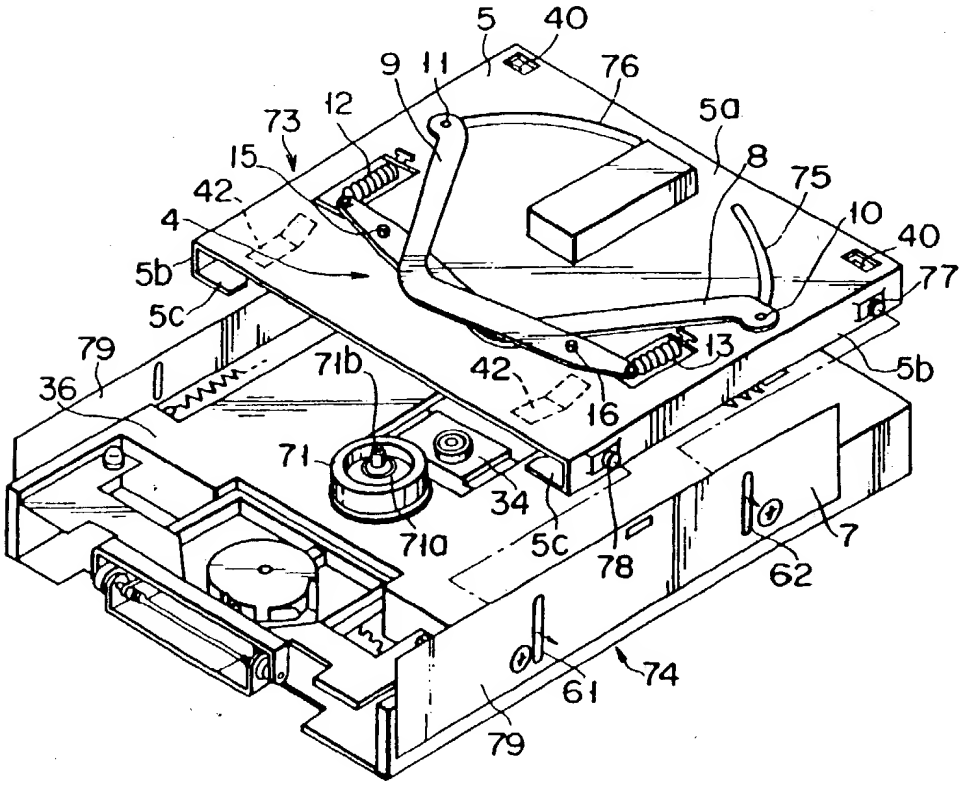

72
30
32
81
84
C
38
51

FIG. 9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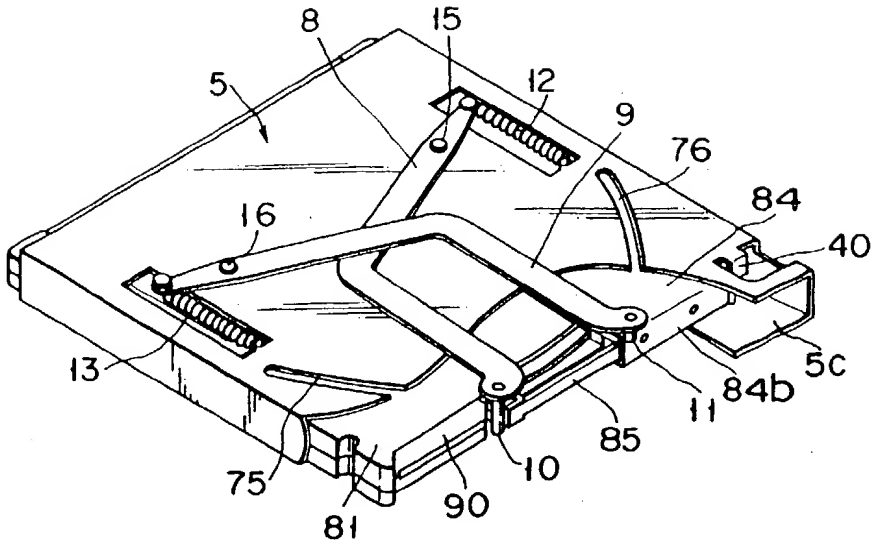
40
9
11
76
12
73
50
15
8
75
42
10
4
40
5b
77
5c
13
79
71b
42
5b
36
16
71
34
710
5c
78
62
7
61
74
79

FIG. 10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5c
84b
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85
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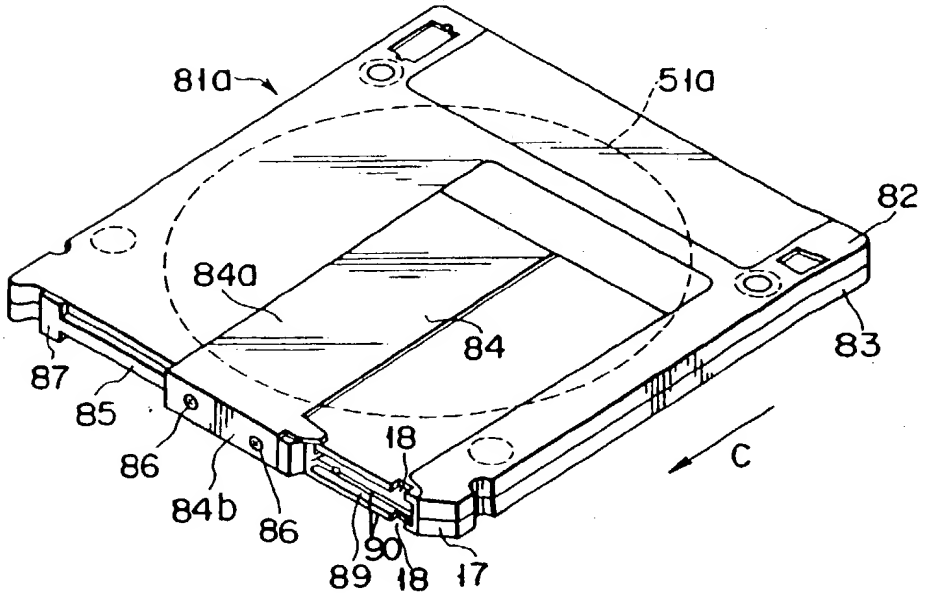
90
81

FIG. 13


81a
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84b
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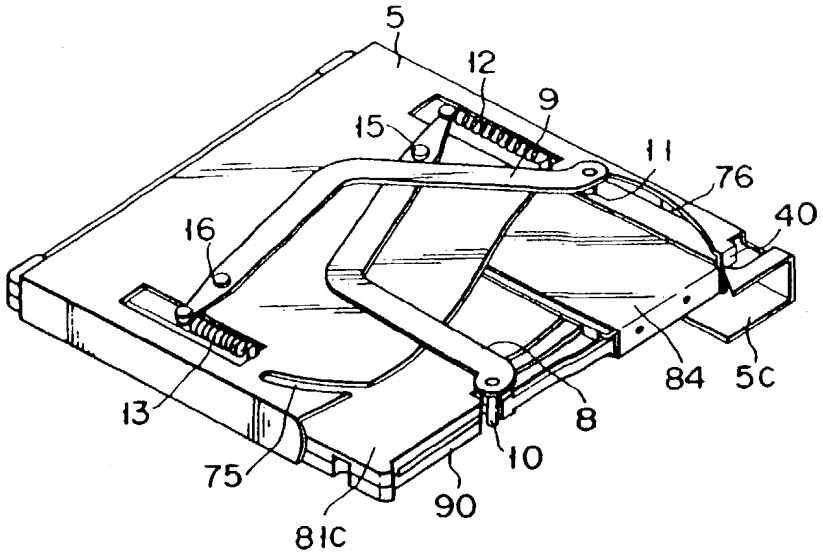
89
18
17

FIG. 14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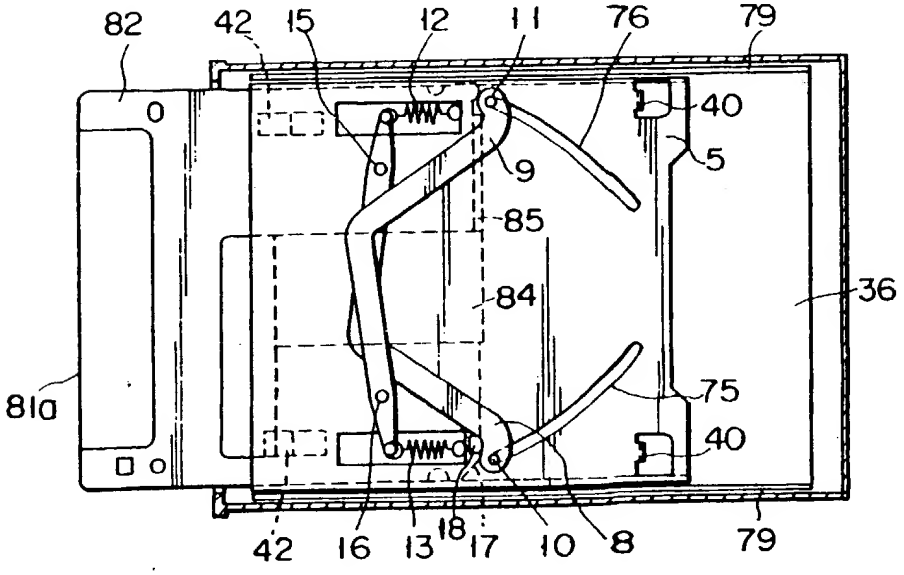
81C

FIG. 17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81D
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8
79

FIG. 18

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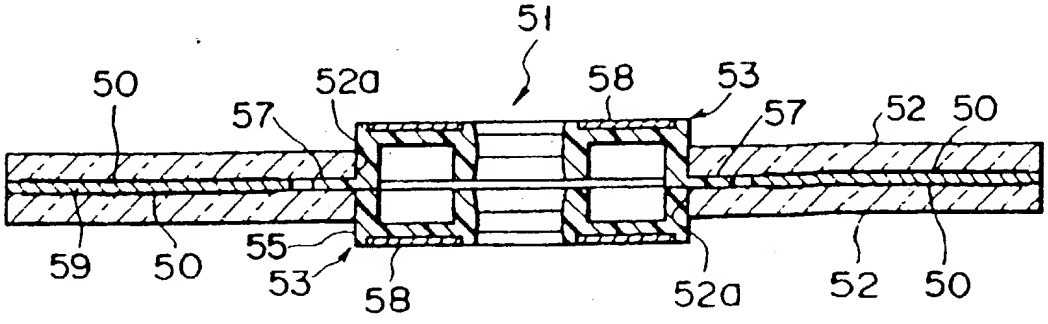

FIG. 1

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